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FOREWORD

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**CONFERENCE ON THE PROBLEM OF SUN-TROPOSPHERE**  
relationship and solution of problems related  
- USSR -  
and research work to solve these problems  
by Yu. V. Spiridonova

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# CONFERENCE ON THE PROBLEM OF SUN-TROPOSPHERE

- USSR -

[Following is a translation of an article by  
Yu. V. Spiridonova in the Russian-language periodical  
Izvestia Akademii Nauk SSSR, Seria Geograficheskaya  
(Bulletin of the Academy of Sciences of the USSR,  
Geophysical Series), No. 3, 1960, pages 157-159.]

Between February 8 and 11, an Interdepartmental conference on Sun - Troposphere problems took place in Leningrad. Astronomers, geophysicists, meteorologists, climatologists and physicians participated in its work. Among participants in the Conference, collaborators of the Main Geophysical Observatory (Pulkovo, L'vov) of the Central Institute of the Prognosis, of the Arctic Institute, of the Institute of Applied Geophysics, of the Geographic Institute, of the Agricultural Economy Institutes, etc... took part in it. Altogether, up to 120 persons were present at the session.

The terms of reference of the Conference, as V. A. Krat had observed in his introductory address, consisted in outlining the level and the status of the work along heliogeophysical relationships, and in attempting to clarify the possibility of utilizing the results of these works for the prognosis. Taking into account the present-day state of scientific knowledge about the Sun, research undertakings in this field have broad perspectives.

As is known, ultra-violet radiations are almost completely absorbed in the ionosphere, which thus appears to be serving as a life on Earth defensive screen. The corpuscular radiations, i.e., the stream of charged particles basically get into near-polar regions and are responsible for aurorae polaris, and for magnetic storms. Recent investigations have shown that the role of X-ray radiations of the Sun is also great.

It is known that the solar activity, whose visible manifestation consists in a number of sun spots on its surface, in chromospheric flashes, etc...., has a cyclical character. Astronomers concluded that the solar activity cyclicity is multirhythmic. Among these cycles, the best studied is the eleven year one, or the Brinkner cycle, and the 33 year one. It is assumed that there exist cycles with 80 to 100 year periods (century cycles), the multicentury one, and also the 5 to 6 years period cycle. The discovery of the multirhythmicity in the manifestations of helioactivity is particularly complicating the Sun phenomena prognosis.

The general increase in solar activity of the past 50 years, and the unusually high peak of 1957-1959, is explained by the overlapping of several rhythms (at least four), and by the coinciding of their maxima (M.S. Eigenson, V.A. Krat, B. M. Rubashev).

In the papers presented to the Conference by climatologists and meteorologists, a basic attention was given to the half-century record of solar activity with manifestations in the troposphere and in the hydrosphere. This is, first of all, a question of intensity and character variation of the general atmospheric circulation, and the oscillation of lakes and river flow levels.

A. A. Giers established that with the increase of solar activity, the general atmosphere circulation intensity also increases, and meridional processes begin to dominate the zonal ones.

A. L. Katz reaches the same conclusion in his investigations about the quantitative calculations of meridional and zonal transfers in the Northern Hemisphere troposphere in different solar epochs.

The estimate of helio-terrestrial relationships was given in a report by B. A. Apollov by means of an analysis of Wolf number curves for 50 years, of the Volga flow and of the Caspian level oscillations. High correlation factors ( $-0.7 - 0.9$ ) were then obtained and which characterized inverse relationships. The increased hydrologic phenomena intensity in determined years is explained by the increase of solar activity intensity.

The terrestrial phenomena relationship with the 11 year solar activity cycle was clearly reflected in the major part of the reports submitted. A. V. Shnitnikov proves this by an example of river flow and lake level oscillations in Sweden. The area was not accidentally selected: The author showed that rivers and lakes appear to be definite agents in the variation of moist conditions precisely over hard underlying formations such as the granites and gneiss of Scandinavia. By opposition, the rivers of the Russian plain provide somewhat more leveled a picture, as they flow through loose deposits, and are partially regulated by the friable nature of the ground.

A particular attention was given in the Conference to the possibility of existence of areas more or less sensitive to solar activities. In particular, it is assumed that in the development of meridional processes in the atmosphere, the most sensitive, and therefore obvious appeared to be the sectors with the predomination of Southerly or Northerly waves, the intermediate zones showing less well defined relationship.

S. I. Kostin has proved an 11 year cyclicity in the growth of yearly tree rings and its inverse relationships with the march of solar activity. Aside from that, the observed quick withering of forest and oak groves of the European part of the USSR which started in the thirties, is also, in his opinion, connected with the solar activity increase. On the other hand, the increase of the general

atmosphere circulation intensity, and of the interlatitude exchange following the growth of solar activity, leads to a greater frequency of anomalous summers. Under a relatively scarce recurrence of the so-called "normal" summer seasons, either very dry years, quite favorable to the development of forest pests, or very humid ones, when the forest is beset with fungi diseases - take place.

In connection with the fact that the peak of solar activity has passed, fact which most astronomers and geophysicists now take for granted, climatologists and meteorologists forecast a change in the meteorological changeability sign.

A great deal of attention was given by the Assembly to episodic solar actions upon the troposphere.

L. A. Vittels put forward a theory based on L. R. Rukipova's calculations relative to baric formations in the multilayer atmosphere, according to which it is possible to forecast the influence of corpuscular waves on the lower atmosphere processes. The original corpuscular flow velocity determines the depth of their penetration in the atmosphere. Depending upon the baric field's sign in the given layer, the corpuscular wave may stimulate, or to the contrary, shut-off cyclones and anticyclones of the lower layers. M. I. Kamenskaya tried to give a mathematical computation of disturbance transfers from the upper to the lower atmosphere layers. It resulted that the action effect is very small, but the author does not consider this result as final, as up to now, there is no possibility to record temperature variations at the upper atmosphere boundary.

T. V. Pokrovskaya, utilizing the methodology of American scientists Dylli and Creig, found that magnetic storms have repercussions on troposphere processes. These actions are of a force equal to that of the atmosphere's own disturbances, such as for example large cyclones, considering of course their respective dimensions.

B. I. Sazonov tried to clarify the relationship of shortlived solar actions with the formation of macrosynoptic processes. In that case, warm blocking anticyclones were taken as acting agents on corpuscular waves. It was assumed that the areas of Iceland and Alaska were most subject to solar actions, since they lay at the intersection of the magnetic storms circle, and of the most active cyclone-generating areas. The verification carried out by means of Northern Hemisphere weather maps of the past ten years, had confirmed that hypothesis.

Part of the reports was devoted to the appraisal of prognosis relationships with the continuity of synoptic processes, taking into account the solar activity indicators. Yu. B. Khrabov has shown, that in the extreme solar activity epochs, the relationships between synoptic processes in time become better, and may be used in the prognosis.

B. M. Rubashev, using circulation types determined by B. I. Dzerdzeevskiy, has analyzed the probability of zonal and meridional positive and negative anomalies as related to the character of solar activity pattern. In this way, good prognostic relationships for separate months were obtained.

A considerable auditors interest was also aroused by N. A. Shultz reports (Sochi's Resort Management) on the influence of solar activity changeability on men's blood production, and N. S. Sheherbinskiy's report (VASKHNIL) about the rythmicity of the catastrophic desert locust reproduction.

The Conference has thus shown that the given problem was oriented towards various directions by the investigators' efforts. Moreover, works include quantitative appraisal of the heliogeophysical relationships, aside from their qualitative analysis. The variety of approaches tends to confirm that the solar activities mechanism upon the troposphere is in many respects not quite clear as yet.

The Conference went on with a considerable animation. This concerned more particularly the appraisal of the upper layers disturbance transfer effects on the lower ones, the appropriateness of the correlation method utilization in monotonous solar activity patterns and terrestrial processes, the question of using integral curves or slipping means, about the further applications of the Wolf number, not reflecting the corpuscular radiation's changeability, etc....

The vitality of the proposed question appeared clearly in the course of the Conference. The improvement of calculation and observation methods, the use of electronic computers, and also the entirely new data received from satellites and space missiles, authorize the astronomers to introduce new energetic solar activity indicators. Some of them, besides reflecting the intensity, also record the fluctuations of solar activity, such as for example the solar phenomena oscillations sharpness index, as proposed by Eigerson.

The astronomers and geophysicists efforts are now directed towards the verification of the "constancy" of the solar constant, the study of transfer mechanism from the upper to the lower atmosphere, of sun-originating disturbances, and also the study of transparency oscillation factor at the atmosphere boundary, and the related consequences in the troposphere.

In this respect, heliogeophysics open broad possibilities for research.

In view of the united effort and a coordinated work, the Conference passed a resolution establishing a Special Committee on Sun-Troposphere problems.